

# Robot-Assisted Resection of a Retrocaval Peridiaphragmatic Mass

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## ABSTRACT

A peridiaphragmatic mass that is located in the retrocaval space typically requires a wide incision and retraction of the peritoneal organs or great vessels to remove the mass. The laparoscopic method is very challenging because of unsatisfactory visual fields and a lack of range of movement from the instruments. We present the advantages of robotic surgery in the removal of deep retrocaval tumors, a procedure that requires careful dissection and minimal retraction.

**Key Words:** Robotic surgery, Retroperitoneal tumors, Bronchogenic cyst.

## INTRODUCTION

Bronchogenic cysts arise from a tracheal or bronchial diverticulum.<sup>1</sup> These cysts are usually solitary and lined by cuboidal or columnar ciliated epithelium and mucus glands. Roughly two-thirds of cysts are found within the mediastinum. Cysts in the pulmonary parenchyma typically communicate with a bronchus, whereas those in the mediastinum do not. Close to one-third of patients are asymptomatic, with diagnosis made after a routine chest radiograph is obtained. Many patients, however, present with respiratory complaints, including recurrent pneumonia, cough, hemoptysis, or dyspnea. Because of these symptoms, as well as reports of neoplasm occurring within these cysts, treatment for all bronchogenic cysts requires resection.<sup>2,3</sup>

With the continuous development of the robotic system, the spectrum of the laparoscopic approaches has increased, due mainly to the enhanced vision and ergonomics.<sup>4–6</sup> A peridiaphragmatic mass that is located in the retrocaval space typically requires a wide incision and retraction of the peritoneal organs or great vessels to remove the mass. The laparoscopic method is very challenging because of unsatisfactory visual fields and a lack of range of movement from the instruments.

We present the advantages of robotic surgery in the removal of deep retrocaval tumors, a procedure that requires careful dissection and minimal retraction. This is the first case of totally robotic resection of a retrocaval peridiaphragmatic mass.

## CASE DESCRIPTION

A 41-year-old, white man presented with right-sided neck pain that radiated to his chest, along with shortness of breath for 3 months. He felt some dull pain during his daily job, and pain was aggravated by deep inspiration and improved by analgesics. He had never felt symptoms similar to these. His medical and surgical histories were unrelated, and he had no known drug allergies. His familial history was significant because his grandfather had a pulmonary embolism.

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DOI: 10.4293/108680813X13654754535070

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The physical examination showed an overweight man (height of 5 ft 7 in and weight of 194 lb). He denied any shortness of breath and coughing. He had some pain on the right side of the neck, as well as in the chest, which had improved. He denied any fever. His vital signs were all within normal range. There was no abnormal finding in physical examination including the neck and chest area. A chest radiograph did not show any lesions, and the arterial blood gas analysis was in normal range. Besides the patient's familial history of pulmonary embolism, we could not find abnormal findings in his previous evaluations, so we decided to obtain a chest computed tomography scan. The scan ruled out pulmonary embolism but identified a  $6.4 \times 4.8$ -cm mass in the right upper quadrant of the abdomen along the dia-

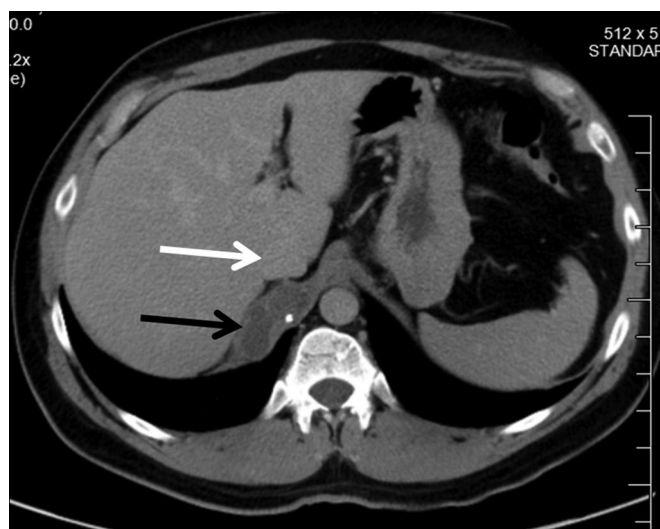
phragm (**Figure 1**). The mass was partially calcified, in the right hemidiaphragm, and did not appear to have attached to any vessels. It was identified as a retrocaval peridiaphragmatic mass.

Although the mass was located posterior to the liver and in close contact to the diaphragm, a minimally invasive robotic approach was attempted.

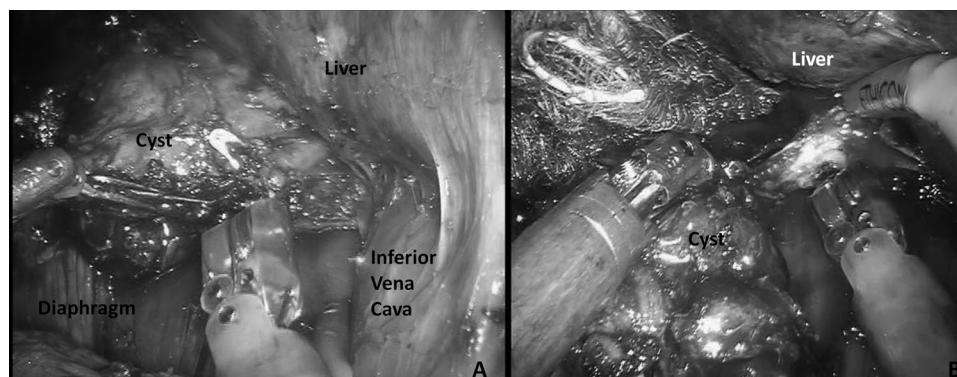
## OPERATIVE PROCEDURE

The patient was positioned supine in the reverse Trendelenburg position at  $30^\circ$  and tilting of the left side at  $20^\circ$ . A transperitoneal approach was used, and insufflation was obtained with a Veress needle technique. A 10/12-mm camera port was placed 2 inches above the transverse umbilical line, along the right pararectal line, with another 10-mm trocar placed on the left side of the umbilicus. Two 8-mm trocars were placed on the left upper quadrant, and one 8-mm trocar was placed lateral in the right upper quadrant. After trocar insertion, the da Vinci Surgical System was docked from the patient's head. The first step of the dissection was to position the fourth arm so that it could lift the right lobe of the liver. We then took down the ligaments of the right lobe to retract the liver and expose the vena cava. While the assistant pushed the kidney down, we reached the base of the diaphragm and the upper portion of the retrohepatic vena cava (**Figure 2**). A mass contained inside the psoas muscle and diaphragmatic insertion was composed by multiple cystic cavities. A sample was sent for frozen pathologic evaluation.

The content of the cyst was similar to a mucinous type of fluid. The lining inside the cavity was smooth and



**Figure 1.** Chest computed tomography scan showing a peridiaphragmatic mass (black arrow) posterior to the inferior vena cava (white arrow).



**Figure 2.** Cystic resection. (A) Dissection of a cystic mass located posterior to the liver, between the inferior vena cava and diaphragm. (B) Final step in the resection.

thin, and there were no projections or tissue growth inside. The cyst had the appearance of a benign lesion, which was confirmed by the pathology report. As a result, we resected the lesion in a pericapsular manner without attempting a more radical procedure with muscle destruction. The lesion was completely removed after controlling the vascular supplies from the cava vein using non absorbable sutures. The specimen was placed in a bag retrieved through a trocar site.

Overall blood loss was <100 mL, and the operation time was 109 minutes. The patient tolerated the procedure well and had an uneventful postoperative course. He was discharged on postoperative day 2. Final surgical pathologic analysis showed a bronchogenic cyst.

## DISCUSSION

To date, there are few reports available that describe the robotic approach to removing retrocaval tumors, although some reports are available describing robotic surgery for mediastinal, retroperitoneal, and paravertebral masses.<sup>7-9</sup> These reports describe the advantages of the robotic system and focus on the minimal morbidity, reduced hospital stay, and rapid recovery normally associated with robot-assisted procedures. Lehrfeld et al.<sup>10</sup> reported robot-assisted excision of a retroperitoneal mass between the left renal artery and vein performed successfully. Yang et al.<sup>11</sup> reported robot-assisted resection of a paraspinal schwannoma performed uneventfully.

In the case of a deep-seated tumor, particularly in the retroperitoneal or retrocaval area, the anterior approach is the most used method. Still, a relatively large incision is required, and the risk of great vessel and adjacent organ injury or nerve injury is substantial.

Laparoscopic surgery can result in shorter hospital stays, early recovery, and better cosmetic outcomes. Still, in the case of a deep-seated tumor, surgeons may be uncomfortable with the limited range of movement provided by the laparoscopic instruments, as well as the inability to perform complex tasks such as microdissection and suturing.

The robotic surgical system can offer clear, 3-dimensional images and enable delicate dissection from major vessels. It can also offer freedom of motion comparable with human hands. We can feel more comfortable when performed suturing, and the fear of bleeding is lessened. Suturing during laparoscopic surgery takes much

more time than that with a robotic system. Also important is the robot's ability to automatically eliminate any hand tremor and provide the surgeon with a 540° wrist action. In this case the robot allowed for minimal retraction of the liver and limited damage to the psoas muscle and major vessels, as well as meticulous bleeding control with a magnified view.

There are some limiting factors in robotic approaches. One of the most important is the associated cost. Another factor is the lack of tactile feedback, which became a weak disadvantage mainly due to enhanced surgical dexterity that the system offers that allows a faster learning curve.<sup>12</sup> The robotic approach can be particularly useful in performing difficult tasks in narrow areas, where the system allows for great dexterity as shown in this case.

## CONCLUSION

To our knowledge, this is the first reported case of a totally robotic excision of a retrocaval peridiaphragmatic mass. Among other benefits, the use of the robotic approach prevented the need for traumatic open access.

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